THE POLAR TIMES

United States' base at the South Pole.

Study May Hold Key to Antarctic Living

SYDNEY, Australia (UPI)— Scientists involved in a five-year international study of man's reaction to the Antarctic think maybe a cold bath is as good as a warm blanket.

A 12-man scientific team that spent three months in northern Antarctica said the studies so far have been "remarkably successful."

"This is the most comprehensive, detailed study yet of man's reaction to the Antarctic," a spokesman for the expedition said. Six volunteers endured neck-deep immersion in daily cold baths as part of the team's research.

After weeks of laboratory tests at Sydney University's Commonwealth Institute of Health, the International Biomedical Expedition to the Antarctic spent 65 days camping out in temperatures ranging from minus 18 to minus 34 degrees Fahrenheit to measure reactions to the Antarctic environment. Expedition members brought back thousands of pages of data and several hundred cassettes containing 24-hour physiological readings.

The group's goals were unique in that they went to the Antarctic not to seek geographical or geological discoveries, but to ascertain man's reaction to the Antarctic environment. The results of the expedition's experiments will probably not be known for at least a year.

"There will probably be a large population in the Antarctic in the near future," an expedition member said. "The answers we sought were how man adapts to the cold, the isolation and the stresses . . . viruses and other factors."

The expedition was organized by the Scientific Committee on Antarctic Research and has participants from Argentina, Australia, France, New Zealand and the United Kingdom. Scientists from these countries were divided into two groups. Six attempted to artificially acclimatize themselves to cold before going to the Antarctic and the others served as a control group.

For 10 days the "stalwart six" immersed themselves in cold baths at the Sydney University laboratory for periods of up to one hour, with the water temperature at 59 degrees Fahrenheit.

"Those with more fat stayed longer," an expedition member explained. "All were under strict supervision and body temperatures were taken continuously."

The cold baths were to test a French theory that such cold water immersions temper the body to cold and would make Antarctic residents less sensitive to the extreme polar temperatures.

The field tests were made on the polar ice cap up to 194 miles from the French station Dumont d'Urville.

From there expedition members spent 65 days traveling on snowmobiles and camping in tents, supported by tractors driven by Expeditions Polaires Francaises members which towed their laboratory. The environment and their reactions to it were continuously monitored day and night during their stay in the Antarctic.

"Everybody ate the same French rations," a spokesman said. "They lived in pairs and the main stresses man is likely to encounter in the Antarctic were measured and will be analyzed."

Expedition members' moods were continuously monitored, along with how hard they worked, how warm or cold they got, how much they ate, how they slept, what changes took place in their body temperatures and weight, and what psychological responses occurred in their sleep.

The coming year will be spent processing the data obtained by the five participating nations. A meeting will be held early next year to assess the results and a final summing up will be made in 1983.

The Polar Times

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AUGUST HOWARD, Editor

THE POLAR TIMES highly recommends "The Polar Record," published by the Scott Polar Research Institute, Cambridge, England.

The American Polar Society was founded Nov. 29, 1934, to band together all persons interested in polar exploration. Membership dues are $2.00 a year or $5.00 for 3 years, which entitles members to receive THE POLAR TIMES twice a year.

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New Antarctic Observation Ship Launched at Tsurumi Yard

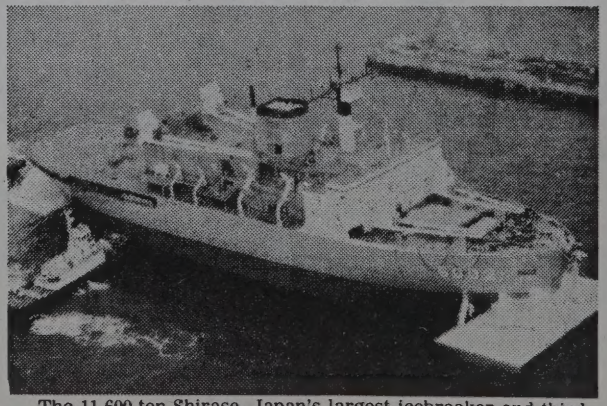
YOKOHAMA (Kyodo) — The 11,600-ton Shirase, Japan's third antarctic observation ship, which is said to be superior in ice-breaking and hauling to its two predecessors, was launched at the Yokohama Tsurumi yard of Nippon Kokan K.K. Friday afternoon.

The ship, work on which was started in 1979 under a four-year program, is to be completed next November and will then undergo tests for about a year. It was named after Lt. Nobu Shirase, who headed Japan's first antarctic expedition in 1910.

It will leave for Antarctica on its maiden voyage with the 25th Antarctic observation team in November 1983, replacing the 5,250-ton Fuji, which has been in use for 16 years. The Fuji left Tokyo for the Antarctic on Nov. 25 with members of the 23rd observation team.

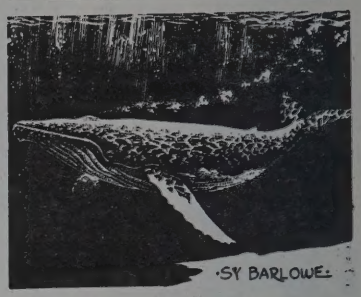
The Shirase is 134 meters long, the Fuji 100 meters. It is powered with engines with a total capacity of 30,000 horsepower, compared to the 12,000 h.p. of the Fuji.

The icebreaker can attain a maximum speed of some 19 knots, three knots faster than the Fuji, and can carry some 230 people, about the same as the Fuji. **Dec. 12**



The 11,600-ton Shirase, Japan's largest icebreaker and third Antarctic observation ship, is launched at the Yokohama Tsurumi Yard.

NATURE WATCH



HUMPBACK WHALE

Megaptera novaeangliae

Size: To 50 feet and about 50 tons.

Color: Black above, white throat and belly. Distinctive scalloped long flippers.

Where found: In all seas, not far from shore. Migrates to warm water to breed and to spend the winter.

Breeding: Mates between October and March. Calf is born in 12 months, weighing about 1½ tons, and is 15 feet long.

Remarks: Slow-moving, playful cetacean; often hurls itself clear of the water. Feeds on krill (small crustaceans) and small school fishes.

Q. *Do whales sleep?*

A. The sleeping habits of whales are poorly understood. Whales do not appear to sleep in the same sense as terrestrial mammals. In deep water, they seem to hang suspended just below the surface, rising periodically for air. In shallower waters, they may lie on the bottom, surfacing occasionally for air. There is some speculation that whales may sleep with half of the brain at a time, with the other half on the alert for danger.

The Polar Times

No. 93 *DECEMBER 1981*

Antarctic Explorers Shift Goal to Hidden Resources

By ROBERT REINHOLD
The New York Times

AMUNDSEN-SCOTT SOUTH POLE STATION, Antarctica — Just 20 years ago, a landmark international treaty set aside the Antarctic continent for scientific and other peaceful purposes "forever" and declared it immune from international discord.

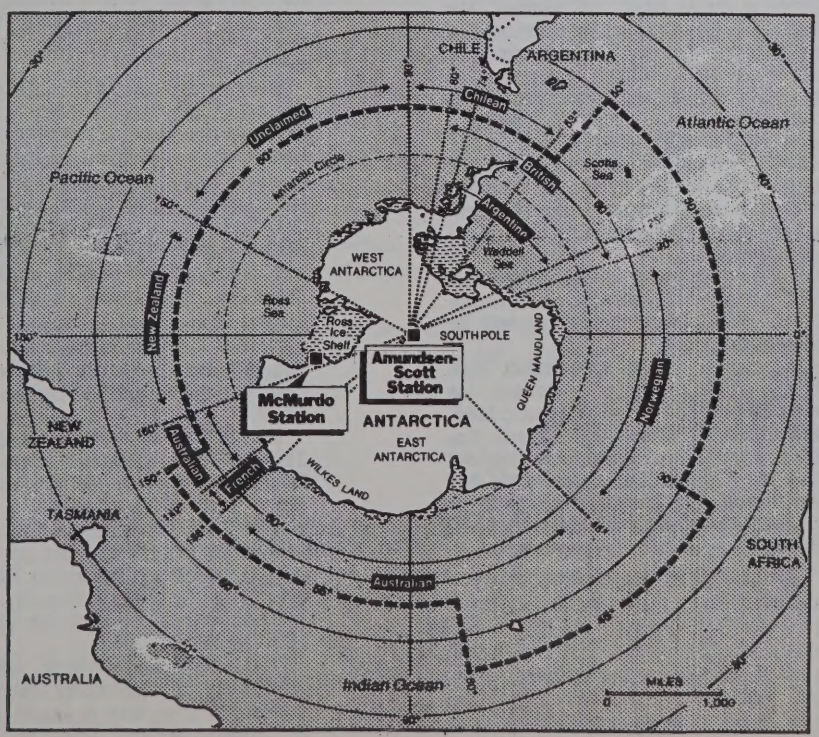
Now, tensions over the fate of the world's last unexploited continent are rising rapidly. The treaty nations realize that Antarctica and its shelf may soon be ripe for commercial development to help satisfy worldwide demands for new food and energy sources.

The treaty is kept alive by a fear among the 14 signatories that the United Nations or another international body will get involved if they fail to resolve Antarctica's political future among themselves. Last July, meeting in Buenos Aires, officials of the 14 countries agreed to develop a regime governing mineral exploitation "as a matter of urgency."

The agreement is just one of many indications that the heroic age of intrepid explorers and scientists has ended. The continent is now almost fully mapped and explored.

Last winter, the crew members at this station installed in their exercise room a Jacuzzi bath in which they luxuriated in warm water while gazing up at these words on the wall: "Great God! This Is an Awful Place." The inscription mocked the last words of Capt. Robert F. Scott, the British explorer who wrote them in his journal before freezing to death returning from the pole in 1912.

Today the pole is served by almost daily Hercules C-130 flights, carrying fresh vegetables and other supplies from McMurdo Station, the main American base 800 miles north of here. McMurdo itself has expanded into a true city with a summer population of 1,000, a 24-hour FM radio station, a television station, 800 telephones, two airfields and 130 buildings.



The New York Times / Dec. 20, 1981

Tensions over the fate of the world's last unexploited continent are rising.

Before the summer ends in February, the ship's store expects to sell 16,000 souvenir T-shirts and sweatshirts emblazoned with penguins and icicles and nearly 3,000 stuffed toy penguins at $11 apiece to Navy personnel, scientists, civilian construction workers and a long list of visitors and tourists.

The promise of riches seems bright enough that numerous countries are making heavy new investments to establish their presence here and to make resource surveys this austral summer.

West Germany offers a case in point. So eager was the Bonn Government to install a permanent Antarctic station before the Buenos Aires meeting that the station was set up 750 miles from the intended spot because the ship carrying it could not break through the ice in time.

The West Germans are also building an $80 million ocean research vessel, and the Japanese National Oil Corporation is beginning the second year of a three-year search for undersea oil. Even Poland, for all its domestic and economic troubles, has been pursuing an ambitious research program, with emphasis on exploiting krill, the tiny shrimplike creatures that are so abundant in Antarctic waters and hold the promise of tripling the world fish catch.

Meanwhile, the Russians have ringed the continent with seven all-year stations, and it is widely suspected in Western countries that they are trying to become the dominant political power on the ice. The United States has only four permanently manned stations.

Such countries as China, Peru, Uruguay, Brazil and Taiwan have also shown new interest.

Ambitious U.S. Program

The United States retains, despite budget cuts in Washington, the most ambitious research program here. This season, the National Science Foundation, which is primarily responsible for the American presence, will deploy 287 scientists on 81 studies of Antarctic glaciology, geology, weather and upper-atmosphere physics.

Among scientists, the spirit of the Antarctic treaty, which calls for scientific cooperation and free exchange of information, persists. Indeed, despite the chill in Soviet-American relations, 13 American scientists are working aboard the Soviet vessel Mikhail Somov.

A steady stream of Russian, Chinese, French, Australian, New Zealand and other scientists is welcomed at McMurdo, Pole, Palmer, Northern Victoria Land and other American outposts.

The prospect of commercial exploitation is not entirely welcome to the scientists, who have long held de facto title to this property. But they seem largely resigned to it.

"There is a lot of unease," said Don-

ald Sineff, a seal expert from the University of Minnesota. "It is inevitable exploitation will take place, but I remain optimistic we can set up guidelines and rules first."

A Matter of Speculation

How soon exploitation will come is a matter of speculation, and predictions are vulnerable to swings in world commodity prices.

"As far as we know, there are no oil or mineral deposits in the Antarctic that are extractable with present technology at today's prices," said James H. Zumberge, a geologist who is the president of the University of Southern California.

"So we are dealing with an academic question for the moment," said Dr. Zumberge, the American delegate to the Scientific Committee on Antarctic Research, an international body studying the possible environmental consequences of large-scale exploitation of the continent. "But God knows what would happen if the Middle East oil was shut off again. It was not too long ago that people said it was impossible to exploit Arctic gas and oil."

What kind of resources might the Antarctic wastes yield, and in what quantities?

Geologists know that the continent has a close geological affinity to South Africa, South America and Australia, all of which evolved from the same supercontinent as Antarctica and have valuable mineral deposits.

About a dozen potentially minable minerals, including coal and ores of copper, lead, gold and iron, are believed to lie in the Transantarctic Mountains. A particularly promising area is the Dufek Massif, a layered rock mass similar to formations in Ontario, Canada, and South Africa that are rich in nickel, chromium, platinum and copper. But none of these commodities are yet so scarce that there is serious talk of mining them here.

One Antarctic resource — krill — is already being harvested by the Soviet Union, Japan and Poland for human and animal consumption. Total annual catch is about 200,000 tons, but the potential has been estimated as high as 150 million tons.

The most enticing prospect is oil. Attention is focused on the western Antarctic continental shelf in the Ross, Bellingshausen and Weddell seas, parts of the shelf once contiguous with the extensive oilfields between Tasmania and Australia before the Southern Hemisphere continents drifted apart. Highly speculative estimates of the Antarctic reserves run to 50 billion gallons or more, even though there is no proof of any oil at all.

Little was known about these resources when the Antarctic treaty was negotiated in 1959 and signed in 1961.

"My profession is geology, and I would not give a nickel for all the mineral resources I know in Antarctica," Dr. Laurence M. Gould, chairman of the National Academy of Science's committee on polar research, told a Congressional hearing in 1960.

It was thus not hard to finesse the territorial claims, some overlapping, pressed by Argentina, Australia, Britain, Chile, France, New Zealand and Norway. The other parties to the treaty — Belgium, Japan, South Africa, the United States and the Soviet Union — neither accept nor dispute the claims.

The treaty, since joined by Poland and West Germany, suspends the claims for at least 30 years, permits free access to all parts of the continent for peaceful uses and prohibits military action and nuclear explosions on all land and ice shelves south of 60 degrees south latitude. The agreement can be altered after 30 years, in 1991.

The treaty appears shortsighted in retrospect because it says nothing about the control of marine and mineral resources. The treaty nations last year signed a convention for the protection and management of offshore marine resources, such as krill. It becomes effective next year, at which time rules and catch limits will be set.

But the mineral question will be far harder to deal with, according to R. Tucker Scully, director of the Office of Oceans and Polar Affairs at the State Department. That is because minerals are nonrenewable and because their exploitation may well require some resolution of the thorny question of who owns the Antarctic land.

"The next four years will determine the fate of the treaty," he said. "The primary fact of life has been that since the early 70's the issue of resources has come to the fore. Generally the parties think the treaty works well and they want to preserve it."

Full Control Sought by Some

The United States favors full access for all, with strict environmental safeguards, while the claimant nations are pressing for full control of mining operations on their territory.

Despite these deep differences, the claimant and nonclaimant members of the Antarctic "club" have a strong incentive to compromise, according to Mr. Scully and foreign diplomats. That incentive is mutual worry that the third world nations will attempt to have the Antarctic resources treated under the "common heritage of mankind" principle that has emerged from the protracted United Nations law of the sea negotiations.

Another incentive is the knowledge that once any substantial recoverable deposits are found, agreement will be almost impossible.

Whether all of the investment here will pay off is a matter of debate. Ice covers 98 percent of the Antarctic land, making mining extremely difficult. Annual temperatures average 50 degrees below zero Fahrenheit, and winds are often fierce. The annual movement of the ice pack would probably limit offshore drilling to the brief summer.

Difficulties Not Insurmountable

The difficulties are not insurmountable, said John Garrett, an official with the Gulf Oil Corporation in Houston who serves on the State Department's Antarctic Advisory Committee. "But we would have to find an awful lot of oil to support commercial production, a darn good field similar to the North Sea," he added.

Moreover, important environmental questions remain unresolved. A panel convened by the Scientific Committee on Antarctic Research in 1979 was cautious about raising environmental alarms, saying much more research was needed. But it raised the possibility that oil spills could endanger the krill population and that drilling operations could interfere with penguin breeding, which takes place mostly on the limited land that is exposed in summer.

All these uncertainties do not seem to have cooled the international fervor.

"There has been a change in perceptions, and regardless of how useful Antarctica really is for resources, most governments now are mostly concerned about resources," said Deborah Shapley, author of the forthcoming book, "Antarctica in a Resource Age," written under a grant from the Carnegie Endowment for International Peace.

"The diplomatic negotiations of the last five years are evidence of that," she said. "They are not talking so much about data exchange and other scientific issues. They are talking about fish and mineral rights.'

Water on Ice

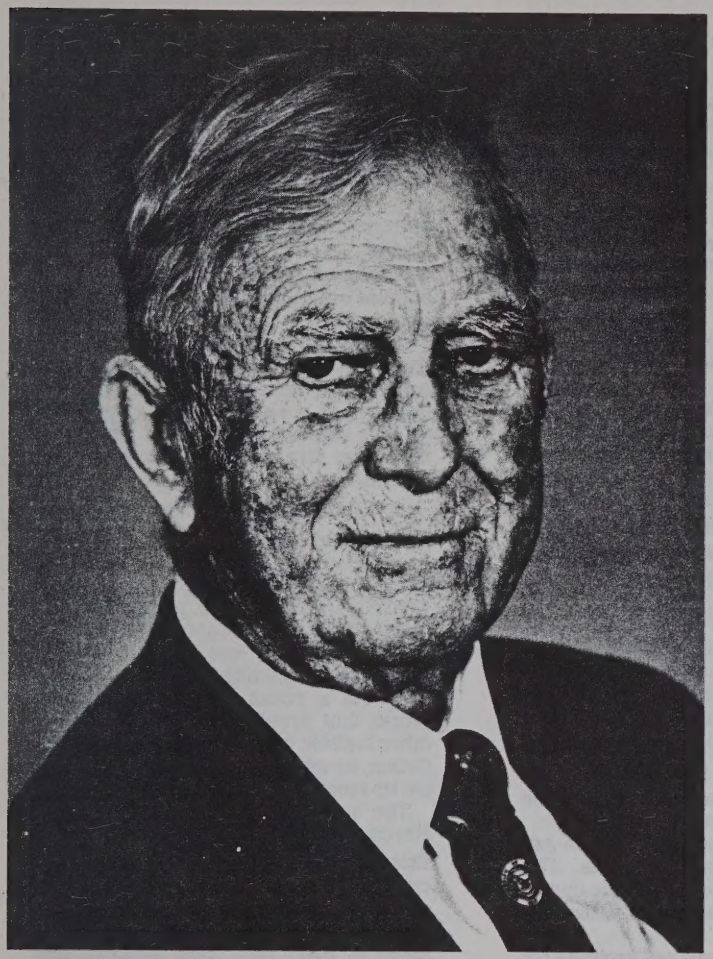
In the next few months a team of 13 American scientists will join a matching group of Russians to ride a Soviet ship in search of a large ice-free body of water, or polynya, that mysteriously forms amid the vast ice fields off Antarctica during the dark and frigid winter there.

Scientists suspect that the polynya, east of the Weddell Sea, is where upwelling warm water "ventilates" and discharges its heat into the atmosphere, cooling that part of the ocean and helping create the flow of frigid, nutrient-rich water that creeps over the floors of the world's oceans. Wherever this so-called Antarctic bottom water rises to the surface, rich fisheries exist.

The first indication of such a large recurring polynya in the Antarctic during winter was recorded by American weather satellites in August 1973, when it was winter in the Southern Hemisphere. It developed more fully in October of that year, then returned annually throughout the southern winters of 1974, 1975 and 1976, growing as large as the entire northeastern United States. It is typically located at about 5 degrees east longitude and 66 degrees south latitude, off the Princess Martha Coast of Queen Maud Land.

The polynya has not been seen since July 1977, but scientists hope it will form again when the Soviet ice-breaking supply ship Mikhail Somov reaches the area next month. The American participants, led by Dr. Arnold L. Gordon of Columbia University's Lamont-Doherty Geological Observatory, are to board the vessel in Montevideo, Uruguay.

If the polynya is found, scientists plan to spend a month in its vicinity, seeking to learn why it exists, its role in dissipating heat into the atmosphere and its influence on the highly productive oceanic life of the region.



LAURENCE McKINLEY GOULD

Stimulating people to think creatively in behalf of the public interest is one of the world's most urgent needs in the 1980s. As geologist, teacher, and college president, Laurence McKinley Gould has stimulated a countless number of persons to search for lasting values, and numerous teachers to become increasingly effective as educators. His years of Arctic and Antarctic research and writing, even before the time of his book, Cold—The Record of an Antarctic Sledge Journey, *1931, have established various benchmarks for additional polar exploration in search of new sources of energy. He was the modest recipient of the Congressional Gold Medal and numerous other honors. He was scientific adviser to various Federal agencies, as well as being the driving member of various international scientific commissions.*

In recognition of these achievements and characteristics the Cosmos Club proudly names Laurence McKinley Gould as the recipient of the Eighteenth Cosmos Club Award.

A Biographical Sketch

Laurence McKinley Gould was born in Lacota, Michigan, on August 22, 1896. When he was seventeen he left for Boca Raton, Florida, where for nearly two years he taught kindergarten through the eighth grade in a one-room schoolhouse.

In 1916 he matriculated in the University of Michigan, intending to study law. He was offered and accepted a room in the home of William H. Hobbs, Professor of Geology at the University, in exchange for tending the furnace and the lawn.

Shortly after his first year he enlisted in the U.S. Army Ambulance Service and served as Sergeant in Section 590 during World War I. In 1917 and 1918 he served with the Italian Army in Italy, and then with the American Expeditionary Forces during the St. Mihiel and Meuse-Argonne offensives and in the Army of Occupation in Coblenz A/R Germany. He was cited for bravery on the battlefields of France.

Upon his return he resumed undergraduate studies at the University of Michigan. He abandoned law for geology.

At Professor Hobbs's urging, Larry Gould, during successive summers (1921-1925), made detailed field studies of the geology of La Sal Mountains in south-eastern Utah as a basis for a doctoral dissertation. He received his B.S. *(magnum cum laude)* in 1921, an M.A. in 1923, and an Sc.D. in 1925 in geology and was elected to Phi Beta Kappa and Sigma Xi. During this period he was appointed instructor in the Department of Geology. Between 1926 and 1932 he was Assistant and Associate Professor of Geology at the University of Michigan.

His lifetime of polar research and publication began with his appointment as assistant director and geologist to Professor Hobbs, leader of the University of Michigan Greenland Expedition, 1926. His professional competence and his unique qualities as a leader easily qualified him for membership on the First Byrd Antarctic Expedition, 1928-1930, as senior scientist and second-in-command. The most remarkable and rewarding scientific accomplishment was his leadership of a 1,500-mile sledging expedition with five associates from Little America into the Queen Maud Mountains.

Highlights of the first two years of his return from Antarctica included the publication of his book, *Cold* (1931), and being honored with the Congressional Gold Medal in 1931, the Chicago Geographical Society Gold Medal in 1931, and the American Geological Society David Livingston Gold Medal in 1930. Significant also was his marriage to Margaret Rice who ". . . enrolled in one of his classes and 'lingered to marry the course'." Through these many years she has contributed much to Dr. Gould's success by her wise counsel and steadfast encouragement.

In 1932 he accepted the offer of an appointment to Carleton College as Professor of Geology and Geography and founder of the Department of Geology and Geography.

During World War II he served as Chief of the Arctic Branch of the Arctic, Desert, and Tropic Information Center of the United States Army Air Corps.

In 1945, Dr. Gould was appointed President of Carleton College, first member of its faculty to be so honored. He served with distinction to his retirement in 1962. As President he was appointed, often as director or chairman, to many committees and long-range investigations and operations, especially relating to Antarctica. He was a member of the Executive Committee and Chairman of the Antarctic Committee of the United States National Committee for the International Geophysical Year (IGY). Following the IGY operations Larry was appointed by the United States National Academy of Sciences to be Chairman of its Committee on Polar Research (1958-1972).

He has been President of the International Scientific Committee on Antarctic Research (SCAR: 1963-1979); Chairman of the Committee on Polar Research (1963-1972); and President of the American Association for the Advancement of Science in 1965.

He is the recipient of twenty-four honorary doctorates and ten medals and awards, and, appropriately, for his life-long contributions to polar science his surname has been given to six different physical features in Antarctica.

As Others Seek to Exploit Antarctic, U.S. Takes the Scientific Approach

By ROBERT REINHOLD
The New York Times / Dec. 21, 1981

McMURDO STATION, Antarctica — Every so often on these bright summer days, a small dynamite explosion shakes the frozen Ross Sea, sending shock waves rippling across the shimmering ice of McMurdo Sound. The waves are refracted from the earth's crust deep below the sound and are picked up by receivers set up at intervals along the ice by Lyle D. McGinnis, a geophysicist from Northern Illinois University.

The goal, said Dr. McGinnis, is to recreate the "tectonic history" — the story of the earth's crust and the forces that created it — of this region and its nearby mountains.

But he readily agrees that the work could be used to search for oil, and indeed, he has found two-mile-deep sediment deposits under the sea floor that strongly suggest the presence of hydrocarbons. Real oil prospecting, though, would require far more sophisticated equipment than he has, Dr. McGinnis added.

Just across the Antarctic continent, in the Weddell Sea, the Japanese have just that. There, the Hakurei Maru, a vessel strengthened to cope with ice and dispatched by the Japan National Oil Corporation, is exploring the sea bottom with an advanced seismic method called "multichannel common depth point" profiling.

The Japanese make no intellectual pretenses about what they are up to. They are looking for oil, not scientific knowledge.

Differences in Approach

The contrast between Dr. McGinnis's academic work and that of the Japanese brings into sharp relief the differences in approach between the United States and many foreign governments toward this vast and largely untouched continent. The United States has long treated it as a rare pristine laboratory for basic research into geological history, weather and atmospheric physics. Other countries, like Japan, perhaps more pressed to develop new food and energy sources, see it as a potential new ground for exploitation.

"The United States is a bit gun-shy about undertaking anything that looks like exploitation," said Charles R. Bentley, a geophysicist from the University of Wisconsin who is a leader in Antarctic research.

The growing international interest in Antarctica has spurred debate in Washington over the American role here. This, coupled with the mounting costs of operating in this harsh environment at a time of budget stringency, has raised some fundamental questions about how best to maintain the American presence in the Antarctic.

In Washington, the National Security Council has completed a review of American policy and forwarded it to President Reagan for a decision. At issue, among other things, is which agency is best suited to carry the flag here and what is the best means of doing it.

The National Science Foundation, which was designated a decade ago by President Nixon as the leading agency in Antarctica, has become increasingly uncomfortable with its role here and the enormous burden imposed on its shrinking budget. The Antarctic programs now amount to nearly 10 percent of the agency's budget.

The foundation's leaders have argued, over considerable dissent within the agency, that since science is only a vehicle for maintaining American strategic and diplomatic interests here, the Department of Defense, presumably through the Navy, or some other agency should assume most of the costs of operations here.

It is unclear whether the Reagan Administration will agree to this. The Navy does not consider Antarctic operations a very high priority and is thought likely to resist this.

Meanwhile, pressures are growing for a somewhat more directed scientific program meant to gather information that would put the United States in a better position to control whatever economic resources might ultimately be found here.

"We are operating on a policy guidance that is 10 years old." said Philip Smith, the former head of the Antarctic program who is now executive director of the National Research Council at the National Academy of Sciences. "A lot of things have changed since then."

He argues that the time has come to put more emphasis on research aimed at mineral exploration and the harvesting of the shrimplike krill and other marine food sources.

Approach Called Deliberate

Dr. John Slaughter, director of the science agency, concedes that the United States has not taken an agressive posture on Antarctic resources. "But to some extent this is deliberate," he said. "We have not felt it is economically justified to spend much money because we are not suffering the same kinds of resource supply problems as other countries."

Dr. Edward P. Todd, head of the foundation's division of polar programs, defended the relatively conservative basic research approach of the American program.

"It will be a long time before anyone makes a dime on Antarctic minerals," he said. "We must first understand the structure of the continent. We are not prospecting for oil. But without a good understanding of the geology we cannot find oil."

Moreover, Dr. Bernhard Lettau, chief of polar ocean programs for the foundation, says that unlike West Germany, Japan, the Soviet Union and other countries, the United States does not suffer from the protein shortages that would impel it to seek new fishing grounds. "There are not out-of-work American fishermen straining to get down here," he said.

Scientific Effort Flourish

American Antarctic science efforts have flourished in recent years as the byproduct of an unusual arrangement whereby the foundation, primarily a domestic agency that supports basic university research, was given a foreign-policy role in holding the American fort here. As a result, the naval support forces that provide transportation and other logistic backup report to the foundation, an arrangement that is not without its tensions.

The science agency owns six huge Hercules C-130 planes equipped with skis, the workhorses of the Antarctic, capable of landing on ice sheets and operated by the Navy. In addition, scientists working here have been given 1,200 hours of Navy helicopter support, and the big orange planes have brought vast areas of rugged Antarctic mountains into easy reach of scientific scrutiny.

All of this has given the United States undisputed scientific dominance over much of the continent. This year, for example, dozens of scientists from several countries have mounted a major geological and glaciological reconnaissance of the mountains of northern Victoria Land. They operate out of an American-run camp, set in an ice-covered basin within the mountains, using a small fleet of ski mobiles and three Navy helicopters, reduced to two by a recent accident.

Meanwhile, extraordinary efforts are being made to maintain a station, named Siple, at the base of the Antarctic peninsula 1,300 miles from here, a spot that has some of the worst weather in the world. But the station is kept because it occupies a unique spot where a key portion of the earth's magnetic field intersects the globe. Siple is therefore crucial to experiments on upper atmosphere physics.

Such efforts have paid handsome scientific dividends over the years. Antarctic research has provided invaluable clues to world weather patterns and given the conclusive evidence for the theory of continental drift. Other work is examining how Antarctic animal and plant life adapt to this extreme environment, while glaciologists are seeking clues to what causes the ice cap to advance and retreat.

But the growing cost of maintaining

such an extraordinary scientific effort, whose practical dividends are long term, are beginning to take their toll. In the fiscal year 1981, $8.8 million of the agency's budget went to research and $55.9 million to logistic support, although the line is hard to draw sharply. In the 1982 budget, research drops to $7.5 million and support grows to $62.6 million. The 1983 research budget is expected to be still tighter, and the officials are making plans to cut back.

The foundation is attempting to minimize the effects by trying to absorb future budget cuts in the logistics.

"It would be a very embarrassing posture for the United States to reduce itself to just a presence in the Antarctic," said Dr. Francis S. L. Williamson, the chief scientist for the agency's Polar Science Division.

Thus, according to Alfred N. Fowler, deputy head of the division, the agency is contemplating the elimination of the annual winter flight to resupply the crew of 100 or so that winters here. The number of Hercules cargo planes may drop from six to four, and plans for a new oceanographic and seismic program based on a ship next year may be abandoned. As it is, the United States has no vessel strengthened to cope with use to use for such research, a major priority of other countries.

Bureaucratic and budget matters are complicated by the larger question of what kind of research should be done here, and whether more stress should be put on resource exploration. To some extent it is an institutional issue. The foundation customarily operates mainly by financing unsolicited research proposals from individual academic scientists. Therefore, it may not be well equipped to mount a more focused resource program, which requires a more concentrated assault on the problem — the kind of work normally done by private companies.

Science and Exploitation

For example, the science agency supports what is regarded as excellent research on the ecosystem and life cycle of Antarctic krill and other living resources here. Other countries, however, are concentrating more on ways of processing the creatures into palatable foods and measuring their abundance. It is the difference between science and exploitation.

R. Tucker Scully, Director of the State Department's Office of Oceans and Polar Affairs and chairman of the Antarctic Policy Group, an interagency panel, said the Government was looking into means of involving other agencies and possibly private companies in Antarctic research to encourage more oil and other resource exploration.

A major deterrent to this is the United State's strict adherence to the principles of the Antarctic treaty, which require that all information gathered in research be fully shared with other nations. American oil companies say they would be unwilling to invest in such costly research, only to have to give away the information.

Japan is also a signatory to the treaty, but it has disclosed little detailed information about its seismic sounding program, according to Dr. McGinnis.

The American program is complicated by its multiple purposes. For example, enormous amounts of money are spent yearly to maintain a large station at the geographic South Pole, even though there is only minimal scientific reason to have a station there.

The station is maintained, American officials readily acknowledge, for political and symbolic reasons: It stands at the intersection of all the national territorial claims to Antarctica, serving as a pointed reminder that the United States does not recognize these claims.

The scientists and officials who work here maintain that it is important for the United States to maintain a highly visible research program. As Richard L. Cameron, director of the foundation's glaciology programs, put it: "If the Russians had studied Alaska, they would never have given it away."

DRUGS ARE AN ISSUE AT THE SOUTH POLE

New Zealand Enrages the U.S. by Intercepting Packages in Drive on Marijuana

By ROBERT REINHOLD
The New York Times

McMURDO STATION, Antarctica, Nov. 27 — The traditionally close cooperation between the United States and New Zealand in the study of Antarctica has been undermined in recent weeks.

New Zealand customs officials have for the first time interdicted, opened and confiscated quantities of United States mail bound for Americans working on this isolated continent.

And the officials say their sniffer dogs have detected 26 parcels containing marijuana and other illicit drugs. They say they will "interview" the addresees when they return later from Antarctica through New Zealand with a view to prosecuting them.

Americans detained in New Zealand will have no right under law to refuse to answer questions. Penalties on conviction vary depending upon the amounts. Importation of large quantities of illegal drugs for distribution can bring up to 10 years' imprisonment.

Anger and Depression

This news has stirred anger and depressed morale among the 1,000 or so American scientists, support workers and Navy personnel on the continent this austral summer. They accused the New Zealanders of opening their first-class letters, seizing magazines, damaging goods and violating their privacy.

The State Department has ordered American officials in Christchurch, New Zealand, where the United States keeps its Antarctic support base, to cooperate with the searches. But high officials of the National Science Foundation, which is responsible for maintaining the American presence here, are so infuriated that they have talked of moving their Antarctic operations to Australia, though the cost makes this unlikely.

While American authorities here say they do not condone importation of illicit drugs, they fear the searches will retard work here, particularly if eagerly awaited Christmas parcels are delayed or damaged. Already about a dozen key construction foremen have declared they will quit and leave the continent if their letters are opened.

The New Zealand action came as a surprise to American officials and raised some complex issues of international law.

The Antarctic mail is sent through the Navy and is considered domestic mail by the United States. In the past it has been treated as mail "in transit" and left untouched in New Zealand when transferred to military craft flying south.

Violation of Rules Cited

A legal memorandum by the Judge Advocate of the United States Naval Support Force, Antarctica, implied that the seizures violated Universal Postal Union Rules guaranteeing "freedom of transit" for parcels.

However, the Assistant Collector of Customs in Christchurch, B. J. Kearns, was quoted in The Christchurch Press as defending the searches on the ground that the mail entered New Zealand territory during its transfer between planes.

"The goods are therefore subject to customs examination in the same way as any other goods entering New Zealand," Mr. Kearns was quoted as saying. He disputed the charges over unnecessary damage.

The commander of the United States Naval Support Force, Capt. Jare M. Pearigen, said in an interview that the seaches had gone a long way toward reducing the use of illicit drugs at American Antarctic stations.

After food, probably nothing is more important than mail from home to the morale of these isolated Americans. They wanted to talk of little else during a recent visit by reporters to research stations scattered over the continent.

At the South Pole station, the workers handed reporters a letter they had sent to The Christchurch Press, signed by 39 members. It accused customs of a "gross and unwarranted breach" of trust between the two countries.

In Hostile Valley, Lichens Pose Antarctic Puzzle

By ROBERT REINHOLD

The New York Times / Dec. 22, 1981

WRIGHT VALLEY, Antarctica — It is difficult to imagine surroundings more inimical to life on this globe than on a mile-high terrace that juts out from the steep barren walls of this Antarctic valley in Victoria Land. Winds of awesome power tear at the sandstone floor and winter temperatures sometimes plunge to 75 degrees below zero Fahrenheit.

But to Imre Friedmann it is a veritable "rain forest."

He bends over, picks up a yellowish piece of porous sandstone and gives it a smart rap with his hammer. The rock splits and reveals a narrow band of green lurking a few millimeters beneath the surface — evidence of one of the most extraordinary adaptations of life to hardship ever found.

The green band is made up of lichens, a marriage of algae and fungal matter, that have managed to find what Dr. Friedmann calls "quite a cozy climate" beneath the surface of otherwise sterile Antarctic rocks. They do so, he recently discovered, not by adapting physiologically to the cold but by changing their growth pattern and shape to enable them to occupy tiny air spaces in the porous rock, where they evade the harsh climate.

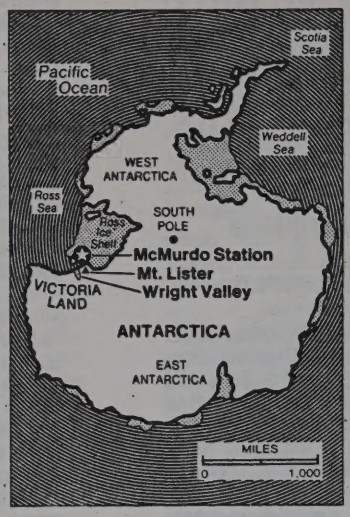
These lichens have attracted the attention of the National Aeronautics and Space Administration, which, along with the National Science Foundation supports Dr. Friedmann's work, because it may give clues about detecting extraterrestrial life. It suggests that if microbial life exists on Mars or elsewhere, it might have to be sought under rock surfaces rather than in surface soils.

In himself, Dr. Friedmann represents an extraordinary kind of biological adaptation. At 60 years old, with gray beard and a bit of a paunch, the Florida State University biology professor might seem at first better suited to stoking a pipe in the faculty club. But here he is, clad in a huge red parka and double-thickness hiking boots, braving some of the worst conditions faced by a scientist.

Annually he and a small team of specialists journey to the ice-free dry valleys of Antarctica. They camp out amid the lichens in small unheated tents under conditions so harsh that plates can only be wiped, for lack of water, and the shortest outdoor stroll can be an intimidating adventure.

After years of work on adaptation to conditions in the Negev and other hot deserts, Dr. Friedmann began to suspect that similar adaptation might occur in the equally arid but cold desert of the Antarctic. This led to the dry valleys, a region of thousands of square miles laced by deep glacier-gouged valleys from which the ice retreated tens of thousands of years ago, leaving bare rock.

Because of the extreme cold and extreme drought here, many biologists have long considered these valleys totally sterile, except around a few



freshwater lakes that melt a bit during the Antarctic summer. Certainly, it was thought, nothing could possibly exist high on the walls of these mountains, in the Asgard range.

Dr. Friedmann has proved them wrong, and he is trying to understand how anything can survive these conditions. He has wired the rocks here like hospital patients, measuring temperature at three-millimeter depth intervals, as well as humidity, sunlight, windspeed and other factors.

Why, he asked, could lichens survive just a few millimeters below the surface but not on it? Lichens are extremely hardy and have been known to endure the temperatures that prevail here. The answer, he has found, is that the surface is afflicted by rapid freezing and thawing caused by gusty winds. On Christmas day last year, for example, rock surface temperatures ranged from 28 degrees Fahrenheit to 42 degrees, crossing the freezing point of 32 degrees 14 times during a 42-minute period. Such freezing and thawing would place extreme physiological stress on any organism.

However, an entirely different world was found just beneath the surface. During the same period, temperatures where the lichens find their niche never dropped below freezing, ranging from 35 to 44 degrees. Sometimes the lichens enjoy temperatures as much as 18 degrees warmer than on the outside. Moreover, the humidity within is consistently far higher than on the rock surfaces.

In this calm refuge, the lichens enjoy a comfortable stable existence, fed by the nutrients in the rocks and watered by the occasional melting of the rare snow.

Laboratory tests on these endolithic, or subsurface, lichens has found them no different physiologically from lichens in more moderate climes. Their photosynthetic behavior is similar, for example, suggesting they have no particular adaptation to cold.

Rather, Dr. Friedmann has recently determined, his lichens are adapted structurally to their unusual world. That is, lichens normally organize themselves into a tissue-like mat in which the algal component is embedded in the fungal structures.

But these endolithic lichens abandon the tissue structure. Instead, the fungus is capable of disorganizing into a filamentous structure, allowing it to penetrate into tiny air spaces between and around rock crystals beneath the surface. Thus they survive by invasion and evasion.

The problems presented by these simple organisms are so complicated that Dr. Friedmann, an algae specialist whose accented speech betrays his Hungarian birth, has brought together an interdisciplinary team. It includes his wife Roseli; Mason Hale, a lichenologist from the Smithsonian Institution who is studying the taxonomy of the organisms; Robie Vestal, a microbiologist at the University of Cincinnati who is tracing the physiology of the lichens by feeding them radioactively marked carbon; and Chris McKay, a graduate student in physics at the University of Colorado who helps with the crucial meteorological instruments.

Back in his own niche at the Eklund Biological Laboratory at McMurdo Station, a short helicopter ride from the Wright Valley, Dr. Friedmann takes samples of the organisms and grows them artificially in test tubes. A key question he is trying to answer is how productive they are. Under optimal conditions they grow quite rapidly. But under the natural conditions of the Antarctic they are often dormant because of the long months of darkness, the extreme cold and limitations on gas exchange imposed by their enclosed environment.

Therefore, this year the team is trying to construct a mathematical model of growth by correlating exterior weather conditions with the microclimate inside the rocks.

Still another major question is how these hardy organisms got here in the first place. Are they relatively recent newcomers blown in with the wind or — a more tantalizing thought— are they the last survivors of the age when the Antarctic was a tropical forest before the southern continents split apart and drifted to the bottom of the world millions of years ago?

"The question hinges on whether there were enough ice-free areas of the Antarctic for these to survive," Dr. Friedmann said, explaining that such organisms might have survived and evolved over the years if at least some mountain peaks have always been ice-free since the first glaciation began more than 30 million years ago.

To answer this he has called on Dr. George Denton, a glaciologist at the University of New Hampshire, who is working in the mountainous northern Victoria Land area this year. While there, on the 13,000-foot Mount Lister, he will look for microorganisms. This mountain, one of the highest on the continent, has the same kind of sandstone in which lichens grow here.

If that mountain turns out to be sterile it would suggest that the lichens did not survive glaciation. At any rate, Dr. Friedmann believes, the lichens are thousands of years old at least.

West German ship sinks

Dec. 19

CHRISTCHURCH, New Zealand (AP) — A West German research ship sank beneath Antarctic ice today after five large helicopters on board rescued its 17 crew members and 25 scientists, National Science Foundation officials said.

A spokesman for the foundation said the ship, the Gotland II, had been trapped in an ice pack for several weeks about 30 miles from Yule Bay. The ice finally crushed the ship's hull and caused it to fill with water, the spokesman said.

The Gotland II left Wellington, New Zealand for the Antarctic on Nov. 14.

Tapping Antarctica's Winds

A major and rising cost item of the extensive American activities in Antarctica is the fuel needed for ships, planes, heating of the buildings and providing electric power.

For a time electricity for the main base at McMurdo Sound was provided by a small nuclear plant, but that proved to be impractical. Under the international treaty governing activities in Antarctica no nuclear waste can be disposed of there. Soil contaminated by the reactor had to be hauled out at great expense.

Now a new source of energy is being considered: wind. Parts of the Antarctic coastline are beset by prolonged and violent winds as cold air flows down off the polar ice plateau. McMurdo Sound is less windy, but Dr. Lawrence B. Scott Jr., professor of aerospace and mechanical engineering at the University of Arizona, has been awarded a $67,688 contract by the National Science Foundation to explore the possibility.

He and his assistant, Robert Watters, are examining various generator designs and plan to leave on Dec. 18 to gather data on possible sites.

Chinese Visit Antarctica

PEKING, Dec. 1 (AP) — Six Chinese scientists have left for short training courses in Australia and New Zealand and will go to Antarctica soon for research, the People's Daily reported today. The six are specialists in oceanography, glaciers, meteorology and geochemistry, the paper said.

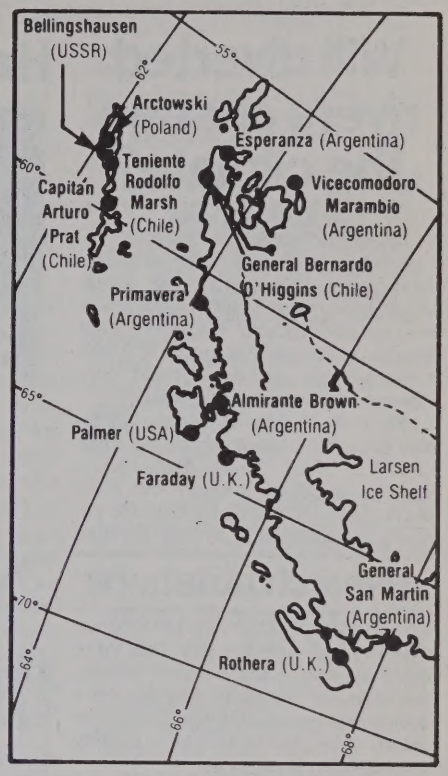
J. P. Katsufrakis honored

U. S. Navy photo by Charles R. Hitchcock.
John Katsufrakis is greeted, as he arrives at Williams Field (McMurdo Station's ice runway), by a National Science Foundation representative.

In February 1981 at a ceremony in Washington, D. C., John P. Katsufrakis received the National Science Foundation's Distinguished Public Service Award. Mr. Katsufrakis, an adjunct professor at Stanford University, was recognized for his outstanding contributions to the U. S. Antarctic Research Program during the past 19 years. The award, presented by NSF director John B. Slaughter, is the highest honor conferred by the Foundation on individuals or organizations for exceptional service to the Foundation.

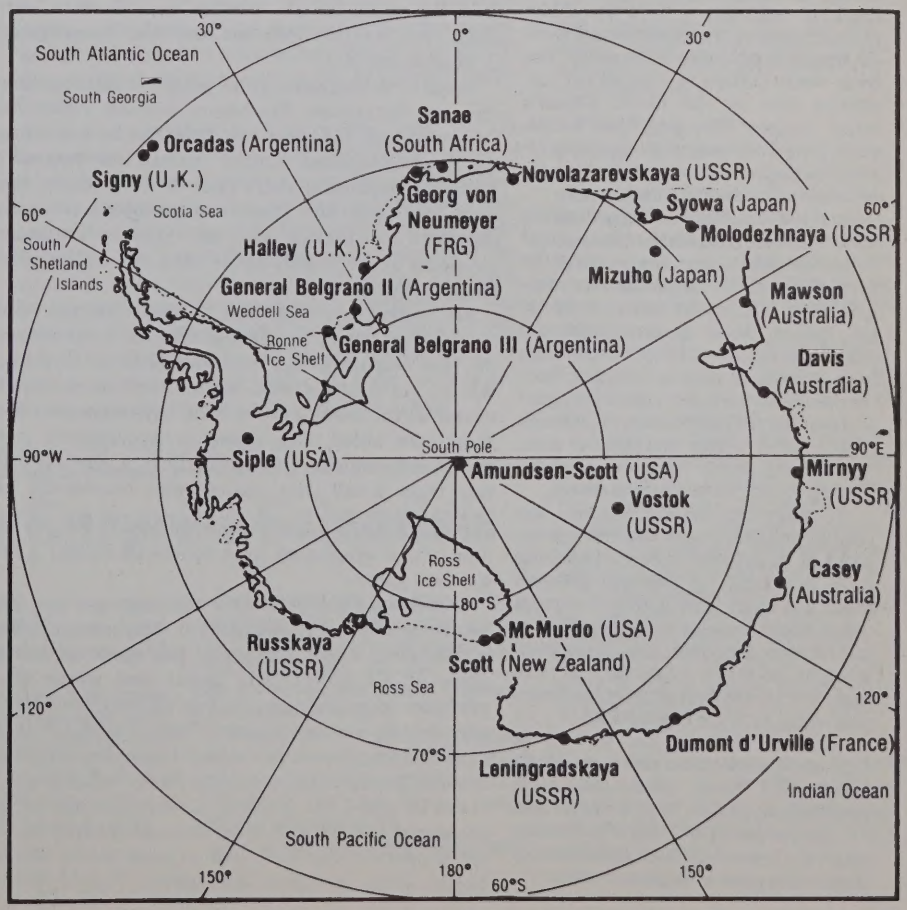
In 1971 Mr. Katsufrakis was asked by the Division of Polar Programs to serve as science program coordinator for Siple Station, then under construction. Located in the remote interior of Antarctica approximately 2,400 kilometers from McMurdo Station, Siple was designed and is used for upper atmosphere research, particularly for controlled studies of very-low-frequency waves. Mr. Katsufrakis assisted with planning for the station, which was completed in 1972, and later with a replacement station, completed for the 1979–1980 season. Since 1971, he has been directly involved in planning science and support activities, selecting and training science support personnel, and operating the station.

Mr. Katsufrakis has worked with the magnetospheric research project at the Stanford Electronic Laboratories, under the direction of Robert Helliwell, since 1961 and has spent 17 austral summers in Antarctica. He has been instrumental in developing Stanford's antarctic research program, which focuses on the behavioral patterns and characteristics of very-low-frequency (VLF) waves. VLF waves are transmitted from Siple along geomagnetic lines of force through the plasmapause and are picked up by a conjugate station in Roberval, Canada. By recording and studying VLF waves traveling through the plasmapause and reentering the earth's atmosphere, Stanford scientists are trying to determine how natural and manmade waves cause particles to precipitate from the earth's radiation belts into the atmosphere. Their research will also help elucidate the dynamics of the magnetosphere and ionosphere in the region of Siple Station. During the 1980–1981 research season, the Stanford team took part in a rocket and balloon campaign at Siple Station to investigate very-low-frequency waves.



Year-round stations of the Antarctic Peninsula.

ANTARCTIC JOURNAL March 1981



The map shows the location of year-round stations in Antarctica, with the exception of Antarctic Peninsula stations.

Will diverted rivers change the climate?

By Robert C. Cowen
The Christian Science Monitor

Long-range Soviet plans to divert rivers now flowing into the Arctic Ocean have raised concern about possible climatic changes. Would this melt the Arctic ice pack or make it freeze more solidly? And how would such changes affect weather elsewhere?

Philip P. Micklin of Western Michigan University has tried to find some answers. Using Soviet data and a greatly simplified (though still complex) computer model, he finds the climatic speculations to be both justified and premature. They are justified because it does indeed appear that there could be substantial climatic effects. But there are neither enough data nor a good enough grasp of the geophysics involved to be able to anticipate exactly what the effects might be.

However, his study does underscore a need to work now to get the necessary knowledge.

The Soviets have for many years talked about diverting water from such rivers as the Northern Dvina, Ob, Pechora, and Yenisey. They would like to send some of these northward-flowing waters to dry lands to the south. The fresh water outflow is a small but significant part of the Arctic Ocean's water budget. Changing that inflow could conceivably have far-reaching effects through feedbacks and other interactions that magnify the impact.

In his study, Micklin focused on the Kara Sea. This area north of the central Soviet Union has about 10 percent of the area of the Arctic Ocean and its marginal seas. It is a major source of Arctic ice. Indeed, Soviet geophysicists consider it, along with northern Greenland, to be a center of regional climatic fluctuation. Also, the river outflow, primarily from the Ob and Yenisey, is a much bigger factor within this smaller area than for the Arctic Ocean as a whole, making its influence easier to detect.

To study this system, Micklin has used a computer model which takes account of 75 different factors, including river flow, and 130 linkages between them. The study indicates the diversion would likely promote system instabilty and increase ice cover. Also, it suggests that the 60 cubic kilometers a year projected for the first stage of the diversion would not have much effect.

However, Micklin has warned in EOS, the Transactions of the American Geophysical Union, "with such a complex system, caution must be exercised . . . careful analysis of impacts of water transfers beyond 60 cubic kilometers is imperative prior to implementation."

research notebook

Harold Muchmore, MD: Antarctic medicine

Early next month, a one-student cram course begins at the University of Oklahoma Health Sciences Center for what may be the most unique assignment in medicine today: solo practitioner at the South Pole.

Hot summertime Oklahoma City seems an unlikely place to prepare for practicing on the world's coldest continent. Nonetheless, each year a young physician-volunteer, destined to be the sole source of medical aid to some 20 scientists and support personnel cut off from the world for 8½ months, goes there to learn about "cold weather isolation medicine" from Harold G. Muchmore, MD.

Despite ranking among the world's medical authorities on Antarctica, Muchmore himself never has "wintered over" at the South Pole. But he has visited the Amundsen-Scott station (named for two early Antarctic explorers) there once or twice every year since 1970 and has spent enough hours in radio-telephone consultation with each year's winterbound physician to thoroughly understand the medical challenges involved.

And each year, of course, brings some new challenges. Two young physicians who have volunteered for this responsibility, including Michele E. Raney, MD, of Los Angeles, who became the first woman to winter at the South Pole in 1979, have consulted with Muchmore about such crises as appendicitis (controlled successfully with antibiotics), a cervical fracture from a fall (this patient also recovered), and embedded glass (successfully removed) in the eye of a man whose eyeglasses were shattered during a racquetball game.

Additional faculty for this mini-course come from among Muchmore's colleagues at Oklahoma's College of Medicine, where Muchmore has spent all but six years of his professional career and where he is professor of medicine as well as adjunct professor of microbiology and immunology. Then, finally, the physician-student moves on to San Diego for additional Antarctic preparatory training from the US Navy.

For 35 years, the National Science Foundation has sponsored the US Antarctic Research Program (with the support of the Navy and to some extent the Air Force). Thus, it was to that agency that Muchmore first applied in 1970 to do Antarctic medical research.

He had been fascinated by Antarctica ever since, as a 12-year-old Boy Scout in Ponca City, Okla, he had heard RADM Richard E. Byrd describe the South Pole and the Scouts who had accompanied his expeditions. "I also used to listen to his radio broadcasts," Muchmore recalls. "They began: 'Hello, America. Antarctica calling.' "

However, it took two psychiatrists from the medical faculty and the Oklahoma City Veterans Administration Medical Center (where Muchmore is chief of the tuberculosis service) to actually get him involved in Antarctic medical research. At that time, Jay T. Shurley, MD, now retired, and Chester M. Pierce, MD, now at Harvard, were studying sensory deprivation and other phenomena of the long isolation period.

(The months from mid-February to early November, during which it is too cold and usually too dark for aircraft to fly into the US research stations, provide "the longest regular isolation of Americans on earth," says Muchmore. "There is no mail, no ingress, no egress." Furthermore, in contrast to the other Antarctic bases along the coast, the Amundsen-Scott station is 1,000 miles inland and a long way from McMurdo, the major station.)

Shurley and Pierce, Muchmore recalls, "tried to interest the rest of us. I resisted the idea, despite my fascination with Antarctica, because I couldn't see what an infectious diseases person could study with the healthy young volunteers who staff that station. Then it occurred to me that, during isolation, perhaps they undergo some changes similar to a person who is convalescing."

Muchmore made his first visit to Antarctica in 1970 and soon put in a research proposal. The project got under way in 1973.

One of the most intriguing research findings so far came during one of those radio-telephone consultations when the incumbent South Pole physician reported some "sniffles" among station personnel. The outbreak occurred about six months into the isolation period, long after a virus should have run its course and disappeared from this small, isolated population.

"This observation continues to be made," Muchmore says. "Our station physician usually notes it in the late Antarctic fall [May] and then again in August or September. It involves from one to eight of the approximately 20 persons at the station. In addition to sniffles, the throat is inflamed, the tonsils are enlarged, and a fever occurs."

Finally, in 1978, Muchmore and colleagues were able to establish what they call "a limited virus laboratory" at the station to try to "capture" whatever viruses were causing the sniffles.

Mammalian cell (human fetal tonsil, HeLa, Vero, and canine kidney) lines were maintained in tissue culture, no mean trick in the harsh and cramped polar conditions, and monolayers grown for study of any viruses that throat swabbings from the volunteers might capture. "As far as I am aware, we were the first to do this, especially maintaining the cultures through the Antarctic winter," Muchmore says.

To the investigators' surprise, more viral shedding was detected—from both asymptomatic and "sniffly" station personnel—than they had typing sera to.

identify. The viruses were eventually identified as parainfluenza virus types 1 and 3.

The Oklahoma investigators were obliged to conclude that, contrary to doctrine that holds that such viruses will die out fairly quickly in such a remote population, the viruses indeed persisted. Furthermore, the viruses were shed by station personnel, many of whom did not appear to be ill, throughout the overwinter isolation period.

The hypothesis, Muchmore says, is that "exposure of the upper respiratory tract to cold, dry air might impair the immune response of the respiratory mucosa. For example, this cooling and drying effect could lead to a reduced output of a secretory immunoglobulin A and other antiviral and antibacterial substances, resulting in either reactivation of an existing viral infection or an increased susceptibility to reinfection" (*Nature* 1981;289:187-189).

"Maybe, in Antarctica at least," Muchmore says, "you really *can* catch cold from the persistence of a virus among persons who appear to be healthy. If we are right, it could mean some changes in viral epidemiology."

He and colleagues did some breath-holding earlier this year while waiting to learn if federal government cutbacks would affect their Antarctic research, particularly their request to send a virologist to the South Pole to study the viral phenomenon further. In April, Muchmore received a kind of 61st birthday present: the news that the research has been funded for another year.

Now he is starting to look for a young, single virologist who is adventurous and a self-starter. "Only five or six physicians who meet our criteria are available each year to winter over in Antarctica," he concedes, "and there may be even fewer virologists.

"Antarctica is a hell of a place to do research," Muchmore adds. "You have to carry everything in and out by airplane, so you think small. The logistics are formidable, but the challenges are fun, too,"

At least the flight to Antarctica has gotten a little less challenging. Newer, faster aircraft now make the trip from the US west coast, via Hawaii, New Zealand, and McMurdo, in less than 25 hours—in contrast to the 40 hours the trip used to take, Muchmore notes.

Nonetheless, he takes along a cribbage board to help pass the time. He rarely plays the game at home in Oklahoma and "never played cribbage at all until I started going to Antarctica."

A number of skills and tools come in handy when coping with science at the South Pole. For example, Muchmore and colleagues have designed a "culture vest" that can hold 126 vials and 12 cell culture flasks. When worn under protective polar clothing, the vest keeps cultures at 23 °C even when the outside air temperature falls below −48 °C.

Back in Oklahoma, in addition to his clinical work and teaching, Muchmore continues to study *Cryptococcus neoformans* serotype groups encountered in the state.

He and co-workers also continue to collect anecdotal accounts of severe upper respiratory infections (URIs) among South Pole station personnel who return to the United States. "I had the worst cold I ever had after I got home" is a common complaint.

"These volunteers are extremely healthy when they go down there," Muchmore points out. "They have to pass a very thorough physical and psychological examination. Still, they appear to have an increased incidence of URIs when contact is resumed with persons outside the small group with which they spent the Antarctic winter. This sort of experience has been mentioned in the past by many persons who have spent time in isolated places, then returned to civilization."

It is unclear whether these URIs result from some kind of transient immunodeficiency. "We think we are beginning to find evidence to suggest subsidance of immunity during those isolation periods," Muchmore says. "But it's still within the normal range, so it is difficult to be sure what is happening. Among other things, we are measuring nasal secretions to see if there are changes."

Regarding his long treks to Antarctica, Muchmore muses, "I am reaching the magic numbers; as you enter your seventh decade, you think about such things." Still, "I have no plans at the moment to stop, nor any retirement date in sight." Actually, before going to medical school at the University of Oklahoma, under the accelerated World War II military program, Muchmore "just wanted to teach zoology. I'm still interested in herpetology. But World War II changed all that; it changed a lot of people's directions."

And now, another Muchmore has been on the Antarctic scene. His son Steven, a 1980 University of Oklahoma (Norman) graduate, worked in Antarctica for five months for the civilian contractor there, International Telephone & Telegraph/Antarctic Services. Like his father, Steven did not take premedical courses but now is planning to remedy that and apply for medical school. Another of Muchmore's four children, Allan, graduated from high school in May and also is very interested in Antarctica. "I guess they must have heard about it from somebody," Muchmore says with a smile.—by PHIL GUNBY

 JAMA, June 5, 1981—Vol 245, No. 21

Quakes in Antarctic Surprise Scientists

From Newhouse News Service

WASHINGTON—Scientists have found that Antarctica, long thought to be uniquely free of earthquakes, does suffer small tremors daily.

The discovery was made by an international team that put three seismometers on Mt. Erebus, the world's southernmost active volcano, in December.

The instruments were intended to study the movement of molten rock inside the volcano. But the seismometers also recorded one or two small quakes a day at distances of 18 to 186 miles.

The quakes measured 3 or lower on the Richter scale, too slight to be felt by humans. Their location was not pinpointed, but they could be related to the continued, slow uplifting of the Transantarctic Mountains about 25 miles from Mt. Erebus.

"Antarctica is no different from anywhere else," concluded geologist Philip R. Kyle of Ohio State University, who led the U.S.-Japan-New Zealand team. "This was a real surprise to us.

"People have always wondered about the mystery of the apparent aseismicity (lack of earthquakes) of Antarctica. Now we have a really simple explanation."

The reason for the seeming lack of quakes, Kyle explained, was that no one had used sufficiently sensitive seismometers on the continent. "This is the first time we know of that anyone has had three high-gain instruments capable of detecting earthquakes of small magnitude," he said.

The team's discovery confirmed a theory, advanced last fall by seismologist Emile Okal of Yale University, that Antarctica does experience earthquakes. Kyle and his colleagues were unaware of Okal's theory when they set out their instruments.

Okal posited his theory after studying long-term records of earthquakes made by seismometers at many locations around the world. No instrument, however, was located in the Antarctic.

He found evidence for two moderate quakes on the continent itself, one in 1972 and a second in 1974.

Antarctica, like all continents, actually rides upon a large block, called a plate, of the earth's outer shell. Its plate boundaries range 1,200 to 3,000 miles from where the Antarctic land mass rises above the ocean, placing the continent in the center of its plate.

Okal compared the total seismic energy released by the Antarctic plate over the last 55 years with that of the African plate, which is comparable in size. He found the amounts of energy released by the two were quite similar. Based on this, he suggested that the continent itself must suffer small earthquakes daily and larger tremors periodically.

Plate Edges Active

Large earthquakes usually occur at plate edges—such as in California where the Pacific and North American plates slide past each other, and along the western coast of South America where one plate dives under another. Devastating quakes rarely occur in the center of plates.

Kyle said the Antarctic activity his team found is comparable to the level in parts of the Midwestern and Eastern United States.

Seismic activity was recorded once before in the Antarctic. But Kyle said the scientist who made the observation interpreted the reading as an icequake generated by the opening of a deep crack in a glacier or the calving of an iceberg.

"We feel quite happy the activity we recorded are not icequakes," Kyle said. "These are due to movements within earth's crust, fractures. They're a good indication of ground movement." Nov. 1

Glaciers normally move a few inches a day, but in 1966, at Mount Steele in the Yukon, a glacier was observed from the air to be traveling at 2 feet an hour.

Ancient Ice Is Yielding Secrets of Past Climate

By WALTER SULLIVAN

An international team of scientists is reading, in six-foot cylinders of ice, the story of the snows that fell when Cro-Magnon artists were painting the images of prehistoric animals on the walls of French caves.

In a highly elaborate and sophisticated experiment, the scientists have drilled almost to the bottom of the Greenland ice sheet, extracting remnants of the snows that built the great mass of ice that bulldozed the Northern Hemisphere more than 60,000 years ago.

May Be 100,000 Years Old

They have now penetrated to 6,687 feet and are drilling through ice made milky by rock "flour," ground from the bedrock by the enormous burden of creeping ice. Earlier, at a depth of 6,455 feet, they penetrated a silty layer perhaps scraped off some summit.

Then 130 feet of clear ice was drilled before reaching the milky layer. The scientists said they expected to hit bottom very soon, where the ice may date back 100,000 years to a warm period before the last Ice Age.

Hidden in the deep layers of ice are samples of the earth's ancient atmosphere, clues to volcanic and climatic factors that led to past ice ages and that could set the stage for a new one.

Clue to Events of 1600's

From these ice samples and those retrieved in earlier, shallower efforts, scientists have reconstructed the most complete history to date of global volcanic activity over the last 10,000 years.

They believe it explains why, according to European accounts, the sun and moon appeared "reddish, faint and lacked brilliance" throughout 1601 and 1602. Ice formed from snows that fell in 1601 and 1602 shows two sharp peaks in acidity attributed to sulfuric acid from major volcanic eruptions.

Researchers from the University of Copenhagen who have reconstructed this history believe that, since these two eruptions were not recorded historically, they occurred in some remote, high latitude region such as Kamchatka or the Aleutians.

A particularly large eruption produced three years of acidic fallout on Greenland about 50 B.C. Accounts of a dimming of the sun after Julius Caesar was assassinated in 44 B.C. are reported in the writings of Virgil and Pliny the Elder, author of a contemporary science encyclopedia.

The drilling, near Dye 3, a radar station 8,700 feet above sea level in southern Greenland, is a joint American-Danish-Swiss effort, with scientists from Iceland and Japan also participating.

Like the North Sea drilling platforms it is a community on stilts, with extensive living quarters, dining facilities and recreation rooms. Every few years it is jacked higher on its stilts to keep it well above the accumulating snow.

As soon as ice samples from great depths reach the surface they begin to undergo decompression changes. Therefore the cores, instead of being airlifted to distant laboratories, as in earlier drilling projects, are being examined in a complex of frigid, subsurface laboratories carved out of the ice.

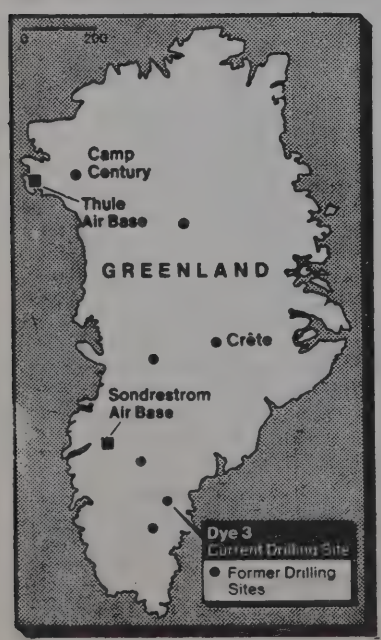
The chambers are linked by tunnels whose walls and ceilings glitter with crystals formed from the humidity exhaled by passing researchers.

In these laboratories a number of discoveries, some of them perplexing, have been made. It has been found, for example, that the snows that fell on central Greenland throughout the final third of the last Ice Age were heavily laden with dust. Then, within less than 20 years as the ice age ended, the dust vanished.

The dust, it is proposed, may have been volcanic or may have blown from vast continental shelves off Siberia and other northern coasts.

Such shelves were laid bare as sea levels were lowered when much of the world's water was locked in ice sheets. As the ice melted and sea levels rose these areas might have been flooded fast enough to cover source regions of the dust within a few years.

Willi Dansgaard, one of the Danish scientists interviewed last week at Dye 3, believes the volcanic record explains a puzzle: the discovery with airborne radar of layering deep within the ice that extends across much of Greenland.



The New York Times / Aug. 9, 1981

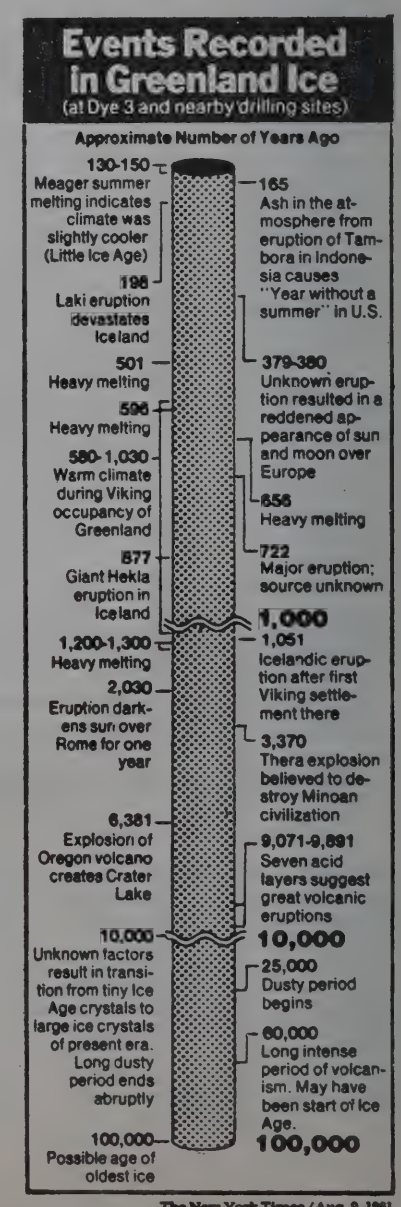
It has now been shown by the drilling, he said, that the layers coincide with periods of intense volcanic activity.

Determining Age of Ice

Dr. Dansgaard has played a leading role in using relative abundances of two forms of oxygen for counting ice layers like annual growth rings. Oxygen comes in two forms or isotopes: oxygen 16 and oxygen 18. The latter is slightly heavier because its nuclei contain two more neutrons. As weather becomes colder, water containing oxygen 18 is less likely to precipitate. Therefore winter snow contains relatively little oxygen 18.

At Dye 3 where several feet of snow accumulate each year, the annual summer-winter cycles can be traced through the relative abundances of these two forms of oxygen. Annual layers for the past nine centuries pinpoint dates of volcanic eruptions with an error margin of only one year. The uncertainty in ice 14 centuries old is three years.

An effort has been made to find evidence of the volcanic explosion at



The New York Times / Aug. 9, 1981

Thera, in the Aegean Sea, that is said to have formed the basis for the Atlantis legend and perhaps contributed to the downfall of the Minoan civilization. The only large eruption in that period, from 1100 to 2700 B.C., shows up at about 1390 B.C. with an error margin of 50 years.

It appears that at least seven great eruptions occurred from 7000 to 8000 B.C., but where is unknown. Beyond about 8000 B.C. it becomes difficult to identify the annual layers, but ages can be roughly estimated.

The oxygen ratios also indicate long-term climate trends. A period of warming when birch trees reappeared briefly in Denmark in the midst of the last ice age is evident in layers laid down 11,000 to 11,800 years ago.

Another aid in year counting and assessment of previous climate has been the percentage of each annual layer showing signs of summer melting. Michael M. Herron, his wife, Susan, and Chester C. Langway Jr. of the State University of New York at Buffalo have found that such layering can be followed 2,200 years into the past.

Dr. Langway, chairman of the geology department at the university, is the senior American scientist for the Greenland drilling. Karl C. Kuivinen of the University of Nebraska at Lincoln is the operational leader. American participation was sponsored by the National Science Foundation.

The summer melts indicate that it was particularly warm from A.D. 950 to 1400, when the Vikings prospered on the nearby Greenland coast. According to the Herrons, in the so-called Little Ice Age in Europe and North America it was colder than normal in Greenland but not radically so.

In 1966 Army drillers reached the base of the Greenland ice at Camp Century in northern Greenland, the only other such penetration. The depth was 4,511 feet, as against more than 6,600 feet at Dye 3.

The only other complete penetration of an ice sheet has been at Byrd Station in Antarctica.

A major challenge at Dye 3 is finding a way to "read" the timetable of changes hidden in lower layers of the ice. In storage there and in Buffalo, where most of the ice is eventually flown, is a priceless record of past climate, changes in atmospheric chemistry, volcanic eruptions and other events.

The layers, however, became so thin near the bottom that they are seemingly indistinguishable. The deeper ice is too old for estimating ages from its carbon 14 content. Among those seeking a new age-determining key are participants from the University of Bern in Switzerland.

One of them, Bernhard Stauffer, believes there is some hope that by combined measurements of two isotopes with longer radioactive lives than carbon 14 — chlorine 36 and beryllium 10 — at least rough ages may be determined.

Examine Dust Particles

A wide range of analyses are conducted in the under-ice laboratories at Dye 3. A laser is used to record dust particles as water is extracted from the ice samples. Acidity of the water is also measured. In a neighboring chamber twin electrodes are drawn the length of each core, after one face of it has been sawed off for analysis in Denmark. This reveals changes in conductivity that indicate periods of acid fallout.

In a "clean room" white-robed technicians under direction of the Herrons capture the ancient air released by melting and analyze the samples for such indicators of past environmental changes as zinc, lead, sulfates and chlorides.

The volume of air retrieved, typically about 10 percent of the sample, indicates the elevation of the surface when that ice was formed. The higher the location, the thinner the air and the smaller its volume in the sample.

A puzzling discovery, according to Dr. Stauffer, is the low level of carbon dioxide in air frozen into the ice in the last Ice Age. In ice formed before the industrial revolution, he said, the level is 275 parts per million.

The current level is 331 parts per million and, because of intense fuel-burning, is rising in a manner that may alter the climate. In the Ice Age, however, it was only 200 parts per million. Finding out why might aid in coping with future trends.

Conservationists Gain a Victory In Hunting Ban on Sperm Whales

By STEVEN RATTNER
The New York Times

LONDON, July 26 — The decision by the International Whaling Commission for a virtual ban on the hunting of sperm wales as its annual meeting in Brighton yesterday represented a victory for conservationists.

In addition to a strong stand against sperm whale hunting, the 30-member group approved a total ban, beginning in 1983, on "cold harpoons," which opponents contend cause whales to bleed slowly to death.

"It was an extraordinary meeting in that I believe we've seen for all intents and purposes the real end to commercial whaling as we've known it over the past 25 years," said Patricia Forkan, vice president of the Humane Society of the United States. "I say that cautiously, but the extraordinary advances in this meeting leave me with no other conclusion."

Conservationists Win a Round

Those steps represented a dramatic reversal of fortunes for conservationists since the 1980 session, when their principal initiatives failed. In addition, the Brighton gathering marked the continuation of a strong stand against whaling by the United States delegation, despite the arrival of the conservative Reagan Administration.

"We're pretty sanguine," said Thomas Garrett, a conservationist who heads the United States delegation, "and I would hope this will be tantamount to a sperm whale moratorium."

The consensus on sperm whaling swung in part because six new members, including China, attended this year's session, some joining the organization in the midst of the two-week conference. In addition, one prowhaling nation, Canada, withdrew. That raised fears of further pullouts, perhaps by Japan, the largest whaling nation, which could result in the collapse of the whaling commission.

"In one word, we are dissatisfied with the results of the meeting," said Shigeru Hasui, managing director of Nippon Kyodo Hogei Kaisha, the Japanese whaling association. "We are trying to avoid taking extreme actions."

Whaling has aroused passions for years, particularly on the part of a variety of humane and environmental groups who oppose whaling, both because of the fear of extermination of the world's largest creatures and because they believe whale hunting is cruel.

As the sessions continued last week at the Metropole Hotel, antiwhaling demonstrators stood across the street by Brighton's pebble beach, holding placards and a large inflated blue whale.

Conservationists did not get all they wanted. Earlier in the week, the group was campaigning for both a moratorium on all whaling and an end to sperm whale hunting. Yesterday's decision was to ban the hunting of sperm whales in all oceans in 1982 except in the area of the western Pacific near Japan, where sperm whaling beyond the 1981 quota will be prohibited at least until a scientific committee considers the question next year.

Aside from sperm whales, the whaling commission made few changes in quotas that have successively reduced the whale catch from 46,000 in the mid-1970's to roughly 14,500 this year and 14,000 next year.

After substantial late-night bargaining, Japan, which cast a lone dissenting vote on the sperm whale proposal, won approval for an increase of 1,030 in the quota for the smaller minke whales, the most abundant species. Iceland and Spain were accorded smaller reductions in the quota of fin whales than had been proposed.

One issue of a year ago, the hunting of bullhead whales off Alaska by Eskimos, barely received a mention. A three-year quota of 17 per year was renewed by consensus after about five minutes of discussion.

Humpback whales swim in circles while emitting streams of bubbles that act like a net to herd krill into a compact mass, which the whales then proceed to eat.

Fate of arctic lab still undecided

The Anchorage Times
Nov. 26

Washington — The federal government is pondering options for the Naval Arctic Research Laboratory at Barrow, which now lies dormant with no federal agency volunteering to step forward and oversee the facility.

The Alaska lands act required the secretaries of interior, defense and energy to review and make recommendations on the need to redirect arctic research policy and the future role of the lab. A study team composed of representatives of those three agencies has released a draft report, detailing four options for the lab.

In addition, public hearings were held last week in Barrow, Fairbanks and Anchorage, with a wrapup session here this week.

At Tuesday's hearing, Sen. Frank Murkowski, R-Alaska, asked that the lab be kept open.

"The closure of the laboratory would leave a void that the nation's scientific community would be hard pressed to fill," Murkowski said in testimony submitted for the record. "I think it is premature to completely shut down our only high arctic research/support facility at a time when we do not have a national arctic science policy."

The lab had been used as a support base by the Navy for arctic research since the 1940s. But the Navy has shifted its research base to Greenland, and the Defense Department has been looking for another federal agency to take control of the lab since February 1977.

If no other federal agency is identified to take over the lab by July, the facility will be closed at the start of the new fiscal year on Oct. 1.

Congress will have the ultimate decision on the fate of the lab, but the prospects for continued federal funding in this era of budget austerity are dubious. Murkowski said he expects Senate hearings to be held early in 1982. He has made the development of an arctic research policy one of his top legislative priorities, and has sponsored legislation to coordinate all Arctic research efforts.

Most of the witnesses at the hearings here and in Alaska supported a continued role for the lab. At Tuesday's session, representatives of the North Slope Borough and the Iniupiat Community of the Arctic Slope asked that the facility be continued.

At a jam-packed session at the Barrow High School last week, local residents testified about the need for the facility to coordinate native research. And representatives of the scientific community at the University of Alaska praised the work done at the lab during a hearing in Fairbanks.

The hearings provided a forum for discussing the options presented in the draft report by the federal study team. Comments by Alaskans will be included in the final report to the secretaries of interior, defense and energy.

The study team identified several issues in the Arctic that could benefit from gathering more research data, including:

— The potential for large-scale climactic change.

— Communication, transportation and other aspects of national defense.

— Resolving conflicts over development and preservation of arctic natural resource and cultural values

The draft report said: "There is considerable, but non-unanimous, support for continuation of the NARL facilities at Barrow. The facilities presently represent a unique resource, which, if properly scaled down and efficiently managed, could provide a logistics and support hub for the conduct of future Arctic research.

"The facilities, including 10 satellite field stations, are well located for supporting investigation of the major Arctic research problems facing the nation, and the physical assets would be very expensive to reproduce," the report added.

The lab could also provide logistics support to visiting scientists and conduct in-house research.

The four options presented in the report range from shutting down the lab completely to increasing federal funds for arctic research and thus expanding the role of the lab. Three of the options would require the state to put up one-third of the funding.

But Alaska Gov. Jay Hammond has said the major financial support for the lab should come from federal funds, since the research is conducted by federal agencies.

The Navy laboratory's base camp consists of 135 buildings, for a total of 400,000 square feet. The original cost of construction was $13.5 million and the replacement cost would be $50 million, the draft report said.

Ship with gold bars reaches Soviet port

Associated Press **Oct. 8**

Moscow — A salvage ship loaded with Soviet gold bars plucked from the sunken wreck of a World War II British warship arrived today in the northern Soviet port of Murmansk to drop off the Kremlin's share of the gold, the Soviet news agency Tass reported.

British salvage officials say the bars that were recovered are worth $74 million at current prices.

Tass said the recovery operation, hampered at times by gale-force winds, had been "successfully concluded."

Murmansk port sources, reached by telephone from Moscow by The Associated Press, said an official Soviet delegation spent several hours aboard the West German-registered salvage ship Stephaniturm after it arrived here.

Officials in Moscow said the Soviet delegation included Anatoly L. Zlobin, vice president of the Soviet state insurance company Ingosstrakh, which is representing Soviet interests in the recovery operation.

The Soviet gold, originally destined for the United States as payment for wartime U.S. arms shipments to the Soviets, was being transported by the Royal Navy cruiser Edinburgh in 1942 when the warship was torpedoed by German destroyers. The Edinburgh was scuttled to keep the gold out of Nazi hands.

The New York Times

Cross shows approximate position of sunken British cruiser. Vessel had embarked from Murmansk.

The gold was hauled up 800 feet through the icy waters of the Barents Sea in a 40-day operation. Twelve divers recovered the bars through a small hole in the Edinburgh's armored hull.

Murmansk is 170 miles west of where the Edinburgh went down, becoming the tomb of 60 British sailors.

In Aberdeen, Scotland, Malcolm Williams, managing director of the British diving company Wharton Williams, said Wednesday that "almost 100 percent of the gold has been recovered.

"What's left is a handful of gold bars which are not considered economically recoverable at this time," Williams said.

Wharton Williams is part of a consortium, headed by a British firm, Jessop Marine Recoveries, which will get 45 percent of the value of the bullion. The Soviet Union gets two-thirds of the balance and Britain, one-third. The United States long ago received insurance compensation for the lost gold.

Many natives live Outside

The latest U.S. Census figures show nearly half this nation's population of Aleuts and about one-fifth of its Eskimos live outside Alaska.

Last year was the first time Eskimos and Aleuts have been counted separately in any state other than Alaska — the native home of all Aleuts and most of this country's Eskimos.

Statistics show 43 percent of the Aleuts and 20 percent of the Eskimos live outside Alaska.

The survey showed that nationally there were 14,177 Aleuts, 42,149 Eskimos and 1.3 million American Indians.

Most of the Aleuts and Eskimos residing outside Alaska live on the West Coast, led by California and Washington.

In Alaska, the population of Eskimos, Aleuts and American Indians climbed from 50,814 in 1970 to 64,047 in 1980. Natives now account for about 16 percent of the state's population.

New definitives will be issued by Ross Dependency Jan. 20.

Ross Dependency will release a new definitive set Jan. 20 marking the 25th anniversary of the opening of Scott Base near Cape Armitage on Ross Island.

The base was established Jan. 20, 1957, for New Zealand's scientific research program on the frozen continent.

The 5-cent value shows Adelie penguins. Well known in this section of the Antarctic continent, they gather each year on the rookeries to mate, hatch and feed their chicks.

Tracked vehicles are featured on the 10¢. The motorized toboggans and sleds used for polar travel replace huskies on most occasions, although dog sledding is still sometimes used around Scott Base.

The 20¢ value depicts Scott Base. It shows how the complex will look in the mid-1980s when all the new buildings are completed.

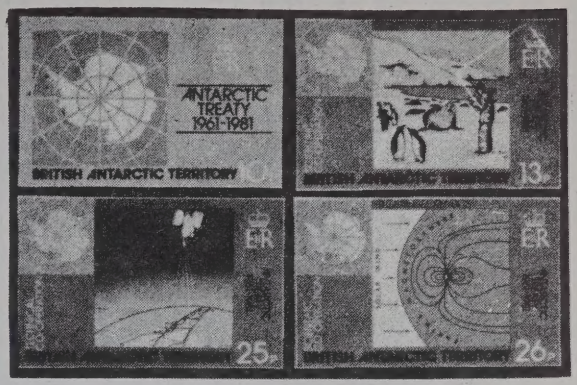
The upgrading and expansion includes the construction of a new laboratory, power house, administration and accommodation facilities.

The 30¢ features a field party with their equipment. This group is working near the unusual stripey mountains of the Upper Taylor Valley.

The Vanda Station, situated in the center of the Dry Valleys, is depicted on the 40¢. This station acts as a summertime base for field parties and search-and-rescue operations.

The 50¢ shows Scott's Hut. Another of Robert Falcon Scott's bases in McMurdo Sound for his 1911-13 expedition, this was the headquarters for his fateful attempt on the South Pole.

LINN'S STAMP NEWS



BAT treaty salute

The British Antarctic Territory marks the 20th anniversary of the Antarctic Treaty with four stamps tentatively scheduled for December, reports Crown Agents, St. Nicholas House, Sutton, Surrey SM1 1EL, England. The set features maps showing the Antarctic (10 pence); scientific cooperation, conservation research (13p); technical cooperation, satellite-image mapping (25p); and scientific cooperation, global geophysics (26p).

Whales are depicted on stamps to be issued by Australia Feb. 17.

Canadian Map Stamps

The history of Canada from 1867 to the present has been traced on four setenant stamps, each showing a map of the nation at each of the four significant points in its development. The stamps have been produced in a miniature pane of 16 stamps, with each of the four stamps occupying its own vertical row.

The four milestone dates are 1867 when Confederation brought together eastern provinces and the nation began to grow rapidly. In 1873, Canada had become a vast land by the acquisition of the Arctic territories of the Hudson's Bay Company. A third map shows Canada in 1905 and the last one the country in 1949.

Confederation united the province of Canada — Ontario and Quebec — with Nova Scotia and New Brunswick. Out of the Hudson's Bay land was created the province of Manitoba and the Northwest Territories. The early 1870's also brought in British Columbia and Prince Edward Island, and Arctic islands ceded to Canada by Britain.

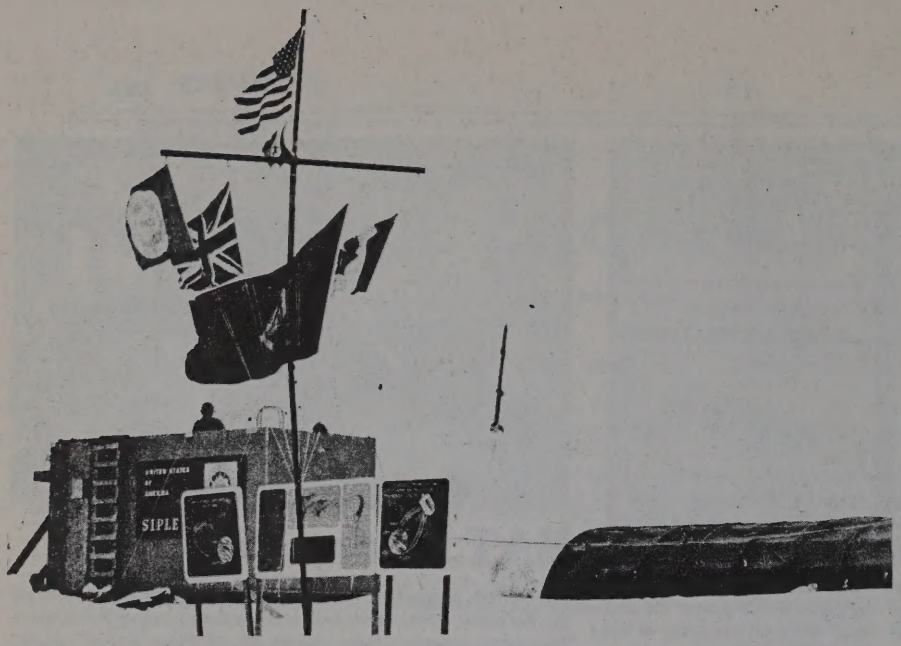
At the turn of the century, to strengthen its authority in a gold rush, Canada created the Yukon Territory, while the provinces of Saskatchewan and Alberta came into being in 1905. Newfoundland finally joined in 1949.

The four stamps, all multicolored 17-cent denominations, use what was described as a color scheme based on the rainbow to depict the provincial boundaries at the four stages chosen for representation.

The issue, put out in observance of Canada Day, was created by Raymond Bellemare, a graphic designer of Montreal.

A Greenland legend is depicted on this 1.60kr stamp

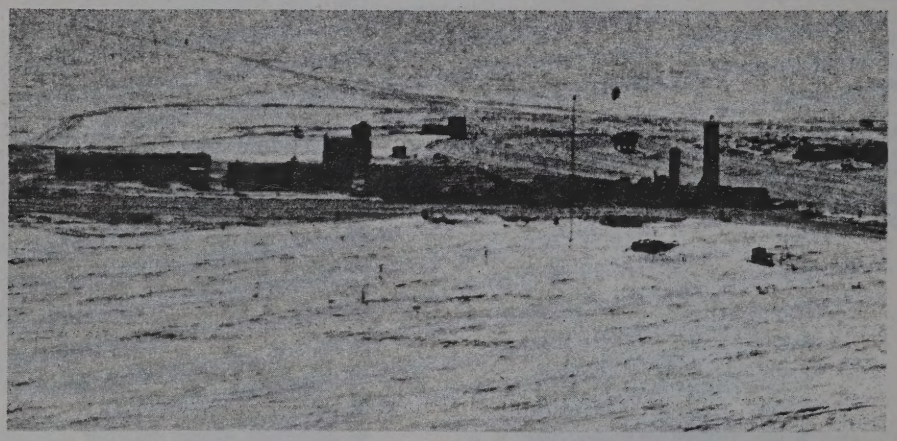
The French Southern and Antarctic Territories released its French Antarctic Treaty 1.80-franc stamp June 23



U. S. Navy photo by Paul Delsignore.

An Arcas rocket is launched from Siple Station during the 1980–81 rocket-balloon investigation of the magnetosphere.

ROSS ICE SHELF PROJECT—This building shelters the U.S. Army Cold Regions Research and Engineering Laboratory's wireline drill, which was used in the 1977-1978 season to extract ice cores from the ice shelf.

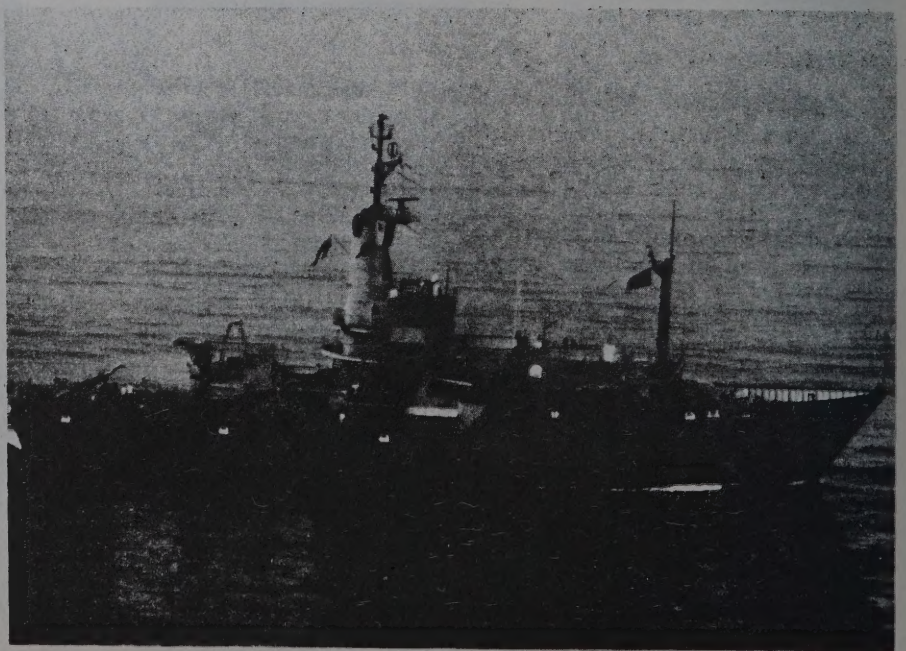


U. S. Navy photo (90230–78) by Doug Nortrell.

Vostok Station (78° 28′S 106° 48′E) the USSR's station located near the geomagnetic south pole.

U. S. Navy photo (XAM–0090–11–79) by Dana B. Babin.

Randy Rice prepares fish nets to collect fish from the water beneath the Ross Ice Shelf for an investigation of protein metabolism in cold-adapted fish.



Scripps Institution of Oceanography photo.

R/V *Melville* participated in a multidisciplinary investigation of the Scotia and Weddell Seas during 1981.